**3GPP TSG-RAN WG4 Meeting #104-eR4-2214482**

Electronic Meeting, August 15 – 26, 2022

**Title:** **WF on FeMIMO RRM requirements for inter-cell beam management and TRP-specific link recovery**

**Source:** **Huawei, HiSilicon**

**Agenda item: 9.17.2**

**Document for: Approval**

# Introduction

This contribution is to capture the agreements for the email discussion for Rel-17 FeMIMO RRM in RAN4 #104-e meeting.

# Way-forward

## Inter-cell beam measurement

**Issue 2-1-1: Whether to consider additional known cell condition**

* Agreements
	+ Don’t need to add an additional known cell condition with L1 measurement only

**Issue 2-1-2 Whether Inter-cell L1-RSRP requirements are applicable for inter cell mTRP**

* Agreements:
	+ No clarification is needed. The existing inter cell L1-RSRP measurement defined in TS 38.133 is applicable for both inter-cell beam management and inter-cell mTRP scenarios.

**Issue 2-2-1: UE reporting behaviour**

* Agreements
	+ No clarification is needed on whether UE shall send L1 measurement report if the known condition is not met.

**Issue 2-3-1 General assumption for sharing factors**

* Agreements
	+ RAN4 do not specify RRM requirements for the following cases:
		- SSBs of CDP are not overlapped with SMTC.
		- SSBs of CDP are fully overlapped with GAP

**Issue 2-3-2 Overlapping SSB definition**

* Agreements:
	+ Have the same SSB index in addition to overlapping SSB window.

**Issue 2-3-3 Applicability of Sharing factors**

* Agreements:
	+ Sharing factors are applicable when any symbol of the SSBs from serving cell and cell with different PCI are overlapping or adjacent (in time domain)..

**Issue 2-3-4 Sharing factors design**

* Principles of Design:
	+ The sharing factors PSC and PCDP between SSB of SC and SSB of CDP for inter-cell BM are introduced without any impacts on the existing L3 measurements
* Based on the remaining L1-RSRP measurement opportunities after punctured by L3 measurements, further study the sharing factor between SSB of SC and SSB of CDP.
	+ Option 1:

|  |  |  |  |
| --- | --- | --- | --- |
| # | Scenario | PSC | PCDP |
| 1 | T’SSB,SC = T’SSB,CDP  | 2 | 2 |
| 2 | T’SSB,SC < T’SSB,CDP  | $$\frac{1}{1-\frac{T'\_{SSB,SC}}{T'\_{SSB,CDP}}}$$ | 1 |
| 3 | T’SSB,CDP < T’SSB,SC  | 1 | $$\frac{1}{1-\frac{T'\_{SSB,CDP}}{T'\_{SSB,SC}}}$$ |

* + Option 2:

|  |  |  |  |
| --- | --- | --- | --- |
| **#** | **Scenario** | **PSC** | **PCDP** |
| A | SC SSB occasions outside MG are fully overlapping with CDP SSB occasions outside MG | 2 | 2 |
| B | SC SSB occasions outside MG are partially overlapping with CDP SSB occasions outside MG | 2 | 1 |
| C | Scenario C: CDP SSB occasions outside MG are partially overlapping with SC SSB occasions outside MG. | 1 | 2 |

* + Option 3: (vivo)
		- The sharing factors PSC and PCDP for inter-cell BM are introduced without impacting the definition of existing sharing factor Psharing factor, where Psharing factor is defined for the sharing factor between serving cell L1-RSRP measurements and L3 measurements.
			* No impacts on the existing L3 measurements.
		- The sharing factors PSC or PCDP is determined in the same way as R15, i.e. by puncturing both SMTC and measurement gaps. PSC or PCDP is valid if there are remaining SSB occasions after this puncturing in the corresponding cell.
			* When puncturing, the max periodicity between SMTC and measurement gap, i.e. max(MGRP, TSMTC), should be considered
		- 1/P should be the ratio of remaining SSB occasions in total SSB occasions after puncturing. P here can be either PSC or PCDP, which is derived based on R15 mechanism.
		- max(MGRP, TSMTC)/TSSB is the total number of SSB occasions within the max(MGRP, TSMTC)
		- 1/P \* max(MGRP, TSMTC)/TSSB  is the total number of left SSB occasions.
		- Since SFNoffset for SSB of SC and SSB of CDP is the same, the SSB with less remaining occasions will be fully overlapped by the other SSB, and therefore should be prioritized. Using SC as example:
			* P = $\frac{P\_{sc}}{1-\frac{P\_{sc}\*T\_{SSB}}{P\_{CDP}\*T\_{SSB\\_CDP}}}$ , if PSC\*TSSB < PCDP\*TSSB\_CDP. (i.e. 1/PSC \* max(MGRP, SMTC)/TSSB\_SC > 1/PCDP \* max(MGRP, SMTC)/TSSB\_CDP, more SSB samples are left after puncturing for SC)
			* P = PSC, if PSC \*TSSB > PCDP \*TSSB\_CDP.
			* P = 2\* PSC, if PSC \*TSSB = PCDP \*TSSB\_CDP.
			* P = PSC, if PCDP is not valid.
	+ Other options are not precluded.

**Issue 2-3-5 Number of non-serving TRPs to be measured for FR1**

* Agreements
	+ Number of other PCI UE can measure for L1-RSRP on FR1 is same as RAN1 capability and i.e., it can be more than 1 and up to 7.

**Issue 2-4-1 Scheduling restriction for dynamic TDD**

* Option 1:
	+ Introduce scheduling restriction for dynamic TDD when L1-RSRP measurement on cell with different PCI overlaps with serving cell UL slots.
* Option 1a:
	+ Introduce scheduling restriction for dynamic TDD when L1-RSRP measurement on non-serving cell overlaps with serving cell UL slots. In addition, one OFDM symbol before and after SSB should also be considered because of TA.
* Option 2:
	+ Do not introduce scheduling restriction for dynamic TDD when L1-RSRP measurement on cell with different PCI overlaps with serving cell UL slots.
* Option 3:
	+ For the scheduling restriction due to L1-RSRP measurement on cell with different PCI, RAN 4 has agreed that the timing offset between serving cell and cell with different PCI should be less than CP, thus no need to introduce additional 1 slot scheduling restriction even considering dynamic TDD.

**Issue 2-4-2 Update capability *simultaneousRxDataSSB-DiffNumerology***

|  |
| --- |
|  |

* Agreements:
	+ No need for updating the capability signaling *simultaneousRxDataSSB-DiffNumerology*.

**Issue 2-4-3 Whether to define scheduling restriction for non-serving cell**

* Option 1:
	+ Introduce scheduling restriction on non-serving cell when UE performs L1-SINR measurement, BFD, CBD, RLM on serving cell.
* Option 2:
	+ Option 1 is not needed.

**Issue 2-5-1: Applicability of ICBM feature**

* Option 1:
	+ For intra-band ICBM using common TCI configurations, different reference CCs in the same CC list between the serving cell and a cell with different PCI is not supported in R17.(ZTE,Intel)
	+ For intra-band ICBM using common TCI configurations, requirements are defined for the case when SSB measurements for a cell with different PCI are only performed in the cell that has the same SSB frequency as the reference CC.
	+ R17 ICBM feature is applicable to FR1 HST and FR2 HST. If RAN4 identifies any issue in applying HST related enhancements to ICBM related RRM requirements, RAN4 solve them in the R17 maintenance phase. (ZTE, CMCC)
	+ R17 ICBM feature is applicable to the scenarios when UE is configured with R17 enhanced gaps. If RAN4 identifies any issue in applying R17 enhanced gaps to ICBM related RRM requirements, RAN4 solve them in the R17 maintenance phase.
* Option 2:
	+ Not in favor of extending ICBM requirements for concurrent R17 Wis

**Issue 2-6-1a: Scenario clarification in the LS [R1-2205640]: SSB and PDCCH/PDSCH are overlapped on the same RE**

* Agreements
	+ SSB from cell with different PCI is overlapped with PDSCH/PDCCH from serving cell on the same RE

**Issue 2-6-2: Whether any clarification or update is needed in RAN4 spec when SSB and PDCCH/PDSCH are overlapped on the same RE**

* Option 1:
	+ No.
* Option 2:
	+ Clarify that performance degradation is expected when overlapping happen in RAN4 spec.
* Option 3:
	+ Clarify that there is no UE requirement when overlapping happen in RAN4 spec.
* Option 4:
	+ Define scheduling restriction to avoid overlap between SSB and data on the same RE in RAN4 spec.

## TRP specific link recovery

**Issue 3-1-1 Wording update and clarification for TRP specific link recovery**

* Agreements
	+ For TRP specific link recovery, it is suggested to use the wording “a serving cell” instead of “a serving cell and cell with different PCI”, where the serving cell can be either configured with additionalPCIList or not.
	+ For TRP specific link recovery, it is suggested to clarify that the SSBs in set and can be indicated to be associated with an additional PCI.

**Issue 3-1-2 Measurement restrictions**

* Agreements
	+ For TRP specific BFD/CBD measurements in FR2, it is suggested that there is no measurement restrictions between BFD/CBD RS resources from different resource sets.

**Issue 3-1-3 Prioritization for beam failure recovery procedure**

* Agreements
	+ RAN4 not to introduce prioritization for beam failure recovery procedure when beam failure recovery happens simultaneously on both BFD-RS resource sets.